

A REVISION OF THE GENUS TETRACTOMIA (RUTACEAE) *

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THE GENUS *Tetractomia* Hooker f. is known to occur naturally from the Malay Peninsula and Sumatra east to the Solomon Islands (see MAP 1). It is remarkably distinct from the other known genera of the Rutaceae in the Indo-Pacific area in having winged seeds in combination with 4-merous flowers, follicular fruits, and unifoliolate leaves. In this region, only *Flindersia* and *Chloroxylon* have similarly winged seeds, but these genera differ from *Tetractomia* in having 5-merous flowers, capsular fruits, and compound leaves, among other characters. The seeds of the monotypic New Guinean genus *Coombea* were originally described as being winged, but in fact they are merely sometimes compressed along part of the margin; each carpel of *Coombea* has two superposed ovules, and, when both develop into seeds, the crowding often results in a flattening of the regions in contact.

Probably the closest relative of *Tetractomia* is a Papuan plant, *Melicope parviflora* C. T. White. Although it lacks winged seeds, this species is similar to *Tetractomia* in having a broad, flattened disc, erect carpels, and opposite, unifoliolate leaves.

Tetractomia has had a taxonomic history of error and confusion, which is surprising since it is so easy to recognize. Joseph D. Hooker established the genus in 1875 (Fl. Brit. India 1: 490, 491), basing it on three species, *T. majus* Hooker f. and *T. roxburghii* Hooker f. (*T. tetrandrum* (Roxb.) Merr.), both from Malaya, and *T. beccarii* Hooker f., from Borneo. In this original description and in a later illustration of *T. roxburghii*, Hooker (in Hooker's Ic. Pl. 16: t. 1512. 1886) clearly and accurately portrayed the diagnostic features of these distinctive plants. Nevertheless, in the first subsequent taxonomic treatment of the genus, Engler (Nat. Pflanzenfam. III. 4: 122. fig. 64, Q-S. 1896) reduced *Tetractomia* to the rank of a section of *Melicope*, apparently overlooking the winged seeds. Engler described the seeds of *Melicope* as ". . . länglich, an der abgelösten Placenta, mit krustiger, glänzender Schale," and under section TETRACTOMIA merely described them as being two per carpel.

In 1915, Ridley (Jour. Fed. Malay States Mus. 6: 141) described as new the genus *Terminthodia*, basing it on a Malayan plant, *Terminthodia viridiflora* Ridley. The holotype of this species, Ridley 16042 (κ), has opposite, unifoliolate leaves, 4-merous flowers with 4 stamens plus 4 staminodes, and winged, albuminous seeds, and is without question congeneric with the original species of *Tetractomia*. Ridley, however, incorrectly described the leaves as being alternate, apparently overlooked the sta-

* This is the eleventh in a series of papers on the Rutaceae of Malesia and Australasia.

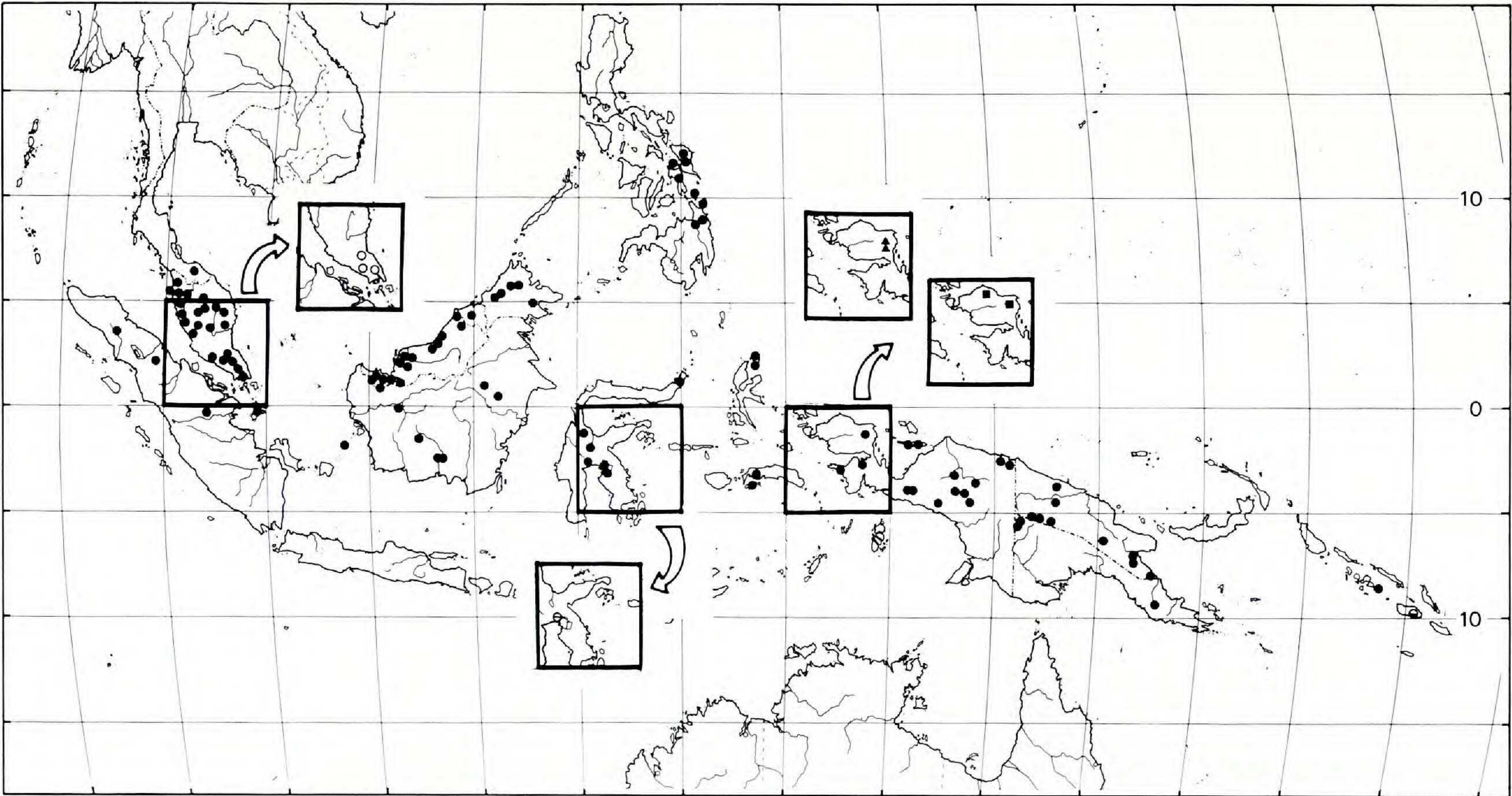
minodes, and misinterpreted the seeds as being exalbuminous. He allied the plant to *Euodia*, stating that *Terminthodia* “. . . differs in its alternate leaves, large square flat disc, and its thin-winged flat seed.” The following year Ridley (Trans. Linn. Soc. London II. Bot. 9: 24. *t.* 1, *figs.* 20–27. 1916) described a second species of *Terminthodia*, *T. oppositifolia*, from New Guinea. Here he correctly described the leaves as being opposite, and the flowers as having 4 staminodes alternating with 4 stamens. He must have been unaware of the details of Hooker's description of *Tetractomia* because his description of this species matches it in all essential generic characters. In 1922 (Fl. Malay Penin. 1: 345, 346), Ridley recognized both *Tetractomia* and *Terminthodia* as occurring in Malaya. Again the latter was incorrectly described as having alternate leaves, only 4 stamens in the androecium, and exalbuminous seeds.

Between the years 1915 and 1930, eight additional western Malesian species were described in *Tetractomia*, six additional New Guinean species were described in *Terminthodia*, and a single New Guinean species, here excluded from *Tetractomia*, was described in *Melicope* section TETRAC-TOMIA. In 1931, Engler (Nat. Pflanzenfam. ed. 2. 19a: 230–233. *figs.* 92, Q–S; 97) again treated *Tetractomia* as a section of *Melicope* and, in addition, recognized *Terminthodia* as a distinct genus. In the latter, the flowers were correctly described as having 4 stamens plus 4 staminodes, but, incorrectly, the leaves were noted to be either opposite or alternate and the seeds were described as lacking endosperm.

The first substantial clarification of this situation was made by Merrill and Perry (Jour. Arnold Arb. 22: 53–55. 1941) in their study of the Papuan Rutaceae represented in collections of the Archbold Expeditions. They pointed out that Engler's treatment of *Tetractomia* as a section of *Melicope* seemed illogical because it placed plants with winged seeds and plants with nonwinged seeds in the same genus; this would be unusual for the Rutaceae. They also noted that all of the New Guinean species described in *Terminthodia* would be more correctly placed in *Tetractomia* and, accordingly, made the necessary new combinations.

Stone, in the only relevant publication since that of Merrill and Perry (in Whitmore, Tree Fl. Malaya 1: 385. 1972), recognized both *Tetractomia* and *Terminthodia* as occurring in Malaya. In the description of the latter, apparently based solely on *T. viridiflora*, he correctly characterized the leaves as being opposite, but incorrectly described the flowers as lacking staminodes and the seeds as being exalbuminous.

I was able to collect and study *Tetractomia* in the field while employed with the C.S.I.R.O. Phytochemical Survey of New Guinea, 1961–1965. (The results of this survey were published in *Lloydia* 36: 217–319. 1973.) This revision is otherwise based on herbarium specimens. The contributing herbaria, with abbreviations from Holmgren and Keuken's *Index Herbariorum*, Part 1, ed. 6 (Reg. Veg. 92. 1974), are as follows: Arnold Arboretum of Harvard University, Cambridge (A); Botanisches Museum, Berlin-Dahlem (B); Bernice P. Bishop Museum, Honolulu (BISH); Herbarium Bogoriense, Bogor (BO); Queensland Herbarium, Brisbane (BRI);



MAP 1. Distributions of *Tetractomia* species: *T. tetrandrum* (Roxb.) Merr. (dots), *T. majus* Hooker f. (circles), *T. barringtonioides* Hartley (circle with diameter line), *T. rotundifolium* (Ridley) Merr. & Perry (triangles), *T. kostermansii* Hartley (squares), and *T. solomonense* Hartley (half-filled circle).

Forest Research Institute and Colleges, Dehra Dun (DD); Botanical Survey of India, Calcutta (CAL); C.S.I.R.O. Herbarium Australiense, Canberra (CANB); Gray Herbarium of Harvard University, Cambridge (GH); Royal Botanic Gardens, Kew (K); Rijksherbarium, Leiden (L); Department of Forests, Lae, Papua New Guinea (LAE); National Herbarium of Victoria, Melbourne (MEL); National Herbarium of New South Wales, Sydney (NSW); New York Botanical Garden, New York (NY); Muséum National d'Histoire Naturelle, Paris (P); Herbarium and Library, Botanic Gardens, Singapore (SING); Botanical Museum and Herbarium, Utrecht (U); Herbarium of the University of California, Berkeley (UC); National Museum of Natural History (Department of Botany), Smithsonian Institution, Washington, D. C. (US); Naturhistorisches Museum, Wien (W); and Instytut Botaniczny, Uniwersytetu Wrocławskiego, Wrocław, Poland (WRSL).

Tetractomia Hooker f. *Fl. Brit. India* 1: 490. 1875. LECTOTYPE SPECIES (chosen here): *Tetractomia majus* Hooker f.

Melicope J. R. & G. Forster section *Tetractoma* (Hooker f.) Engler in Engler & Prantl, *Nat. Pflanzenfam.* III. 4: 122. *fig. 64, Q-S.* 1896.

Terminthodia Ridley, *Jour. Fed. Malay States Mus.* 6: 141. 1915. TYPE SPECIES: *Terminthodia viridiflora* Ridley.

Shrubs or small to large trees; branchlets, buds, and leaves glabrous, or, in some specimens of *Tetractomia majus* Hooker f., leaf blades with minute, scattered, ephemeral hairs below; buds naked. Leaves opposite, unifoliate; petiole flat adaxially, plano-convex in cross section; blade pinnately veined, entire, with scattered pellucid oil dots. Inflorescences paniculate (sometimes reduced to one or a few flowers), pedunculate, from the axils of upper leaves. Flowers bisexual, depressed-rhombic in bud; sepals 4, basally connate, valvate or basally imbricate; petals 4, distinct, valvate or slightly imbricate, acute and minutely hooked adaxially at the apex, spreading and usually becoming recurved; stamens 4, distinct, opposite the sepals, about as long as the petals at anthesis, the filament glabrous, flattened, gradually tapering from the base to a subulate apex, elongating somewhat after anthesis, the anther 2-celled, broadly ellipsoid, obtuse or obtusely mucronulate, dorsifixed, caducous; staminodes 4, alternating with the stamens, about one-half to two-thirds as long as the petals, the filament distinct or partially or entirely adherent to the petals, the anther distinct, minute, triangular, without pollen, persistent; disc intrastaminal, glabrous, broad, flattened or somewhat pulvinate, rounded to 4-angled, the angles opposite the sepals; gynoecium 4-carpellate, the carpels erect, partially embedded in the disc, joined adaxially near the apex by a single style, otherwise distinct or connate toward the base, placentation axile, the ovules 2 per carpel, collateral, the style straight, composed of 4 styler elements twisted together, about half as long as the stamens at the time of anther dehiscence, thereafter about doubling in length, the stigma subcapitate, slightly larger in diameter than the style. Fruits of 1 to 4 erect

follicles, undeveloped carpels, if any, persistent; sepals persistent; petals, staminodes, and filaments of stamens persistent or, in *Tetractomia solomonense* Hartley, deciduous; follicles boat shaped, distinct or connate toward the base, dehiscent along the adaxial edge and down the apical abaxial edge, the outer pericarp (exocarp plus mesocarp) coriaceous, the endocarp cartilaginous, partially separating from the mesocarp. Seeds 1 or 2 per follicle, samaroid, about as long as the follicle; testa pergamentaceous, extended toward the apex of the follicle as a hyaline wing; endosperm copious, fleshy; embryo straight, elliptic, the cotyledons flattened, the hypocotyl terminal.

In his treatment of *Tetractomia* in *Flora of British India* (1: 490, 491. 1875), Hooker attributed two Malayan species to the genus, *T. majus*, which was described as new, and *T. roxburghii*, which was based on *Melicope tetrandra* Roxb. These species were numbered and listed as major entries. A third species, from Borneo, was described (also as new) in the general discussion following the description of the genus. It was referred to as "*H. beccarii*." Also in this general discussion, and in a note following the description of *T. roxburghii*, Hooker referred to *T. majus* as "*H. majus*." In the index to Volume 1, only *T. majus* and *T. roxburghii* are listed, but in the general index at the end of Volume 7, *T. beccarii* is listed as well, with reference to Volume 1, page 491, where "*H. beccarii*" was described.

It appears that Hooker first intended to name the genus *Hymenosperma* and then, when he decided in favor of *Tetractomia*, he (or someone else) failed to make all the necessary changes in the manuscript of his *Flora of British India*; the name *Hymenosperma* appears in Hooker's handwriting on the type sheet of *T. beccarii*, on the Roxburgh plate of *Melicope tetrandra* at Kew, and on page 43, Volume 2, of Maingay's manuscript of the *Flora of Malacca* (also at Kew), which has a description of the collection that Hooker designated as the type of *T. majus*. One of the two Kew sheets of the type collection of *T. majus* also bears the name "*H. majus*" in Hooker's handwriting.

By using the epithet *majus* for one of the original species (the other two being given genitive epithets), Hooker assigned neuter gender to the generic name *Tetractomia*. Most subsequent authors, nevertheless, have incorrectly treated the name as being feminine.

As interpreted here, *Tetractomia* consists of one widespread, polymorphic species, *T. tetrandrum*, and five local species: *T. majus*, from southern Malaya; *T. barringtonioides*, from the Celebes; *T. kostermansii* and *T. rotundifolium*, both from the Vogelkop Peninsula of New Guinea; and *T. solomonense*, from Guadalcanal. Probably the most basic differential characters of these plants are: 1) petals, staminodes, and filaments of stamens persistent vs. deciduous in fruit; and 2) leaves articulate vs. not articulate at the base of the blade. In order to arrange the species in a meaningful sequence, I am grouping them according to these characters and am assuming that the persistent flower parts and the articulated

leaf represent primitive conditions in the genus, while the deciduous flower parts and the nonarticulated leaf are derived. Thus, the species are classified as follows:

- A. Petals, staminodes, and filaments of stamens persistent in fruit.
 - B. Leaves articulated.
 - 1. *T. tetrandrum*.
 - 2. *T. majus*.
 - B. Leaves not articulated.
 - 3. *T. barringtonioides*.
 - 4. *T. kostermansii*.
 - 5. *T. rotundifolium*.
- A. Petals, staminodes, and filaments of stamens deciduous in fruit; leaves articulated.
 - 6. *T. solomonense*.

KEY TO THE SPECIES

- 1. Petiole 0.1–5.5 cm. long, articulated with the leaf blade, the articulation always marked in very young leaves by a transverse line of minute, caducous hairs on the adaxial side of the petiole-blade junction.
 - 2. Carpels in flower densely pubescent; follicles densely farinose-pubescent; petals, staminodes, and filaments of stamens deciduous in fruit. 6. *T. solomonense*.
 - 2. Carpels in flower glabrous or occasionally sparsely pubescent; follicles glabrous or occasionally glabrate; petals, staminodes, and filaments of stamens persistent in fruit.
 - 3. Branchlets 2–8 mm. in diameter; leaf blades 1.1–20(–27) cm. long; pedicels 0.5–4 mm. long; petals 1–4.5 mm. long; follicles 2–11 mm. long. 1. *T. tetrandrum*.
 - 3. Branchlets 8–13 mm. in diameter; leaf blades 11.5–26 cm. long; pedicels 5–7 mm. long; petals about 4.5 mm. long; follicles 9–11 mm. long. 2. *T. majus*.
- 1. Petiole obsolete to 0.7 cm. long, not articulated with the leaf blade, young leaves without a transverse line of hairs at the base of the blade.
 - 4. Leaf blades 2–5.5 cm. long; inflorescences 0.6–3 cm. long. 5. *T. rotundifolium*.
 - 4. Leaf blades 8–25 cm. long; inflorescences 5–22 cm. long.
 - 5. Inflorescences 16–22 cm. long; pedicels 0.5–1 mm. long; petals 1.3–1.5 mm. long; leaves with 8 to 11 main veins on each side of the midrib. 3. *T. barringtonioides*.
 - 5. Inflorescences 5–7 cm. long; pedicels 1–2 mm. long; petals 2.5–3 mm. long; leaves with 6 to 8 main veins on each side of the midrib. 4. *T. kostermansii*.

- 1. *Tetractomia tetrandrum* (Roxb.) Merr. Jour. Straits Branch Royal Asiatic Soc. 76: 87. 1917; Philip. Jour. Sci. Bot. 13: 20. 1918 (in both as "*tetrandra*").

Melicope tetrandra Roxb. Hortus Bengal. 88. 1814, *nomen nudum*; Fl. Indica, ed. 2. 2: 257. 1832; non Blanco, Fl. Filip. ed. 1. 293. 1837. LECTOTYPE (chosen here): Roxburgh Icones 1411, Malaya, P. Penang.

- Evodia pedunculosa* Hooker f. *Fl. Brit. India* 1: 489. 1875. TYPE: *Lobb*, Singapore.
- Tetractomia beccarii* Hooker f. *ibid.* 1: 491. 1875 (as "*H. beccarii*"); *ibid.* 7: 810. 1897 (as *T. beccarii*). TYPE: *Beccari* 1880, Sarawak.
- Tetractomia roxburghii* Hooker f. *ibid.* 1: 491. 1875, *nomen illegit.*, based on *Melicope tetrandra* Roxb.
- Melicope beccarii* (Hooker f.) Engler in Engler & Prantl, *Nat. Pflanzenfam.* III. 4: 122. 1896.
- Melicope roxburghii* (Hooker f.) Engler in Engler & Prantl, *ibid.* fig. 64, Q-S, *nomen illegit.*
- Terminthodia viridiflora* Ridley, *Jour. Fed. Malay States Mus.* 6: 141. 1915. TYPE: *Ridley* 16042, Malaya, G. Tahan.
- Tetractomia philippinense* Elmer, *Leafl. Philip. Bot.* 8: 2813. 1915. SYNTYPES: *Elmer* 13702 & 13751, Mindanao.
- Terminthodia oppositifolia* Ridley, *Trans. Linn. Soc. London II. Bot.* 9: 24. t. 1, figs. 20-27. 1916. SYNTYPES: *Kloss* (*Wollaston Expedition*), 1913, Dutch New Guinea [Irian Jaya], Utakwa River, Camp VIb; *Kloss* (*Wollaston Expedition*), 1913, same river, Camp VIc.
- Tetractomia obovata* Merr. *Jour. Straits Branch Royal Asiatic Soc.* 76: 86. 1917. TYPE: *Clemens* 11025, Sabah, Mt. Kinabalu.
- Terminthodia obovata* Lauterb. *Bot. Jahrb.* 55: 246. fig. 3. 1918. SYNTYPES: *Gjellerup* 589, Nova Guinea Neerlandica [Irian Jaya], near Hollandia; *Schlechter* 19588, Kaiser-Wilhelmsland [Papua New Guinea], Dschischungari.
- Terminthodia schultzei-leonhardi* Lauterb. *ibid.* 245. TYPE: *Schultze* 300, Nordost-Neu-Guinea [Papua New Guinea], Sepik River (not seen).
- Tetractomia pachyphylla* Merr. *Philip. Jour. Sci. Bot.* 13: 19. 1918. TYPE: *Ponce* FB 26985, Philippines, Dinagat Island.
- Tetractomia acuminata* Merr. *ibid.* 17: 265. 1921. TYPE: *Ramos & Pascasio* BS 35135, Philippines, Bucas Grande Island.
- Terminthodia orbiculata* Markgr. *Nova Guinea* 14: 143. 1924. TYPE: *Lam* 1451, Nova Guinea Neerlandica [Irian Jaya], Mt. Doorman.
- Terminthodia treubiana* Lauterb. *Bot. Jahrb.* 14: 142. 1924. TYPE: *Pulle* 1071, Novam Guineam Meridionalem [Irian Jaya], Mt. Treub.
- Tetractomia holttumi* Ridley, *Jour. Bot.* 62: 295. 1924. TYPE: *Holttum* SF 10827, Malaya, G. Belumut.
- Terminthodia lanceolata* Lauterb. *Bot. Jahrb.* 59: 535. 1925. TYPE: *Ledermann* 9914, Neu-Guinea, Sepik Gebiet [Papua New Guinea, Sepik District].
- Tetractomia tetrandra* (Roxb.) Craib, *Fl. Siam Enum.* 1: 215. 1926.
- Evodia leucantha* Lauterb. *Bot. Jahrb.* 61: 30. 1927. TYPE: *Ledermann* 11436, New Guinea, Sepik Exped. [Papua New Guinea, Sepik District], Hunstein Spitze.
- Tetractomia latifolia* Ridley, *Kew Bull.* 1930: 79. 1930. TYPE: *Haviland* 2140, Sarawak, Kuching.
- Tetractomia montana* Ridley, *ibid.* TYPE: *Haviland* 2050, Sarawak, Mt. Bongo [Bungo] near Tegora.
- Tetractomia parviflora* Ridley, *ibid.* 78. TYPE: *Haviland* 2243, Sarawak, near Kuching.
- Melicope philippinensis* (Elmer) Engler in Engler & Prantl, *Nat. Pflanzenfam.* ed. 2. 19a: 233. 1931.
- Tetractomia lanceolata* (Lauterb.) Merr. & Perry, *Jour. Arnold Arb.* 22: 54. 1941.

Tetractomia lauterbachiana Merr. & Perry, *ibid.* 55. Based on *Terminthodia obovata* Lauterb. Non *Tetractomia obovata* Merr.

Tetractomia lauterbachiana forma *pumila* Merr. & Perry, *ibid.* TYPE: Brass 12454, Netherlands New Guinea [Irian Jaya], Idenburg River.

Tetractomia oppositifolia (Ridley) Merr. & Perry, *ibid.* 54.

Tetractomia orbiculata (Markgr.) Merr. & Perry, *ibid.*

Tetractomia schultzei-leonhardi (Lauterb.) Merr. & Perry, *ibid.*

Tetractomia treubiana (Lauterb.) Merr. & Perry, *ibid.*

Shrub or small to large tree to about 35 meters high; branchlets 2–8 mm. in diameter. Leaves 1.2–21(–32) cm. long; petiole 0.1–4.5 cm. long, articulated with the blade; blade glabrous, chartaceous to coriaceous, sub-orbicular to elliptic to oblanceolate, 1.1–20(–27) cm. long, 0.9–10(–14) cm. wide, the base rounded to attenuate, the apex retuse or rounded to acuminate, the main veins 4 to 11 on each side of the midrib. Inflorescences one- to many-flowered, 0.5–19 cm. long, the peduncle, rachis, and branches glabrous to rather sparsely pubescent, the pedicels glabrous to pubescent, 0.5–4 mm. long. Flowers 2.5–10 mm. wide; sepals glabrous to sparsely pubescent, usually ciliolate when young, becoming eciliate, broadly rounded to ovate to triangular, 0.4–1.5 mm. long; petals green, white, yellow, pink, or red, entirely glabrous or rarely sparsely pubescent abaxially, ovate-triangular, 1–4.5 mm. long; stamens with anther 0.4–0.8 mm. long; carpels glabrous or occasionally sparsely pubescent, distinct at the base; style glabrous. Follicles glabrous or occasionally glabrate, distinct, 2–11 mm. long; petals, staminodes, and filaments of stamens persistent in fruit.

ILLUSTRATIONS. J. D. Hooker in Hooker's Ic. Pl. 16: *t.* 1512. 1886 (as *Tetractomia roxburghii*). Engler in Engler & Prantl, Nat. Pflanzenfam. III. 4: 122. *fig.* 64, Q–S. 1896 (as *Melicope roxburghii*). Ridley, Trans. Linn. Soc. London II. Bot. 9: 24. *t.* 1, *figs.* 20–27. 1916 (as *Terminthodia oppositifolia*). Lauterbach, Bot. Jahrb. 55: 246. *fig.* 3. 1918 (as *Terminthodia obovata*). Engler in Engler & Prantl, *ibid.* ed. 2. 19a: 215. *fig.* 92, Q–S. 1931 (as *Melicope roxburghii*). *Ibid.* 19a: 231. *fig.* 97. 1931 (as *Terminthodia obovata*).

DISTRIBUTION. Malay Peninsula and Sumatra east to the Solomon Islands; in various habitats (see under entities); sea level to 3300 meters (see MAP 1).

Peninsular Thailand: Pattani, Betong, G. Ina, *Kerr* 7555 (K). Malaya. KEDAH: Jerai Reserve, *Mat Sani CF* 17918 (SING). PERAK: Bubu Massif, SW. of G. Bubu, *Everett FRI* 13927 (L, SING); Maxwell's Hill, *Whitmore FRI* 12884 (L, SING); Taiping, *Wray* 2106 (SING), 3029 (MEL); Larut, *King's Collector* 5540 (W), 6194 (BO, MEL, SING, U), 6224 (BO, U), 6226 (L, US), 6994 (DD, K, L, UC), *Kunstler [King's Collector]* 6194 (A); Larut Hill, *Curtis (leg. Derry)* 2709 (SING); Bubu Forest Reserve, Sg. Wang, *Ng FRI* 6119 (L, SING); G. Hijau, *Burkill & Haniff SF* 12583 (SING); Hutan Melintang Forest Reserve, *Ng FRI* 5697 (L, SING). KELANTAN: G. Stong, *Whitmore FRI* 12448 (L, SING), *FRI* 12459 (L, SING); G. Rabong, *Soepadmo & Mahmud* 1071 (L), 1163 (BO, L). TRENGGANU: G. Padang, *Hislop*, July, 1952 (SING), *Moysey & Kiah SF* 31096

(BO, SING), *SF* 31098 (SING); G. Padang Expedition, Ulu Brang, *Whitmore FRI* 12648 (L, SING), *FRI* 12779 (L, SING), *FRI* 12793 (L, SING); G. Mandi Angin, *Cockburn FRI* 10789 (L), *FRI* 10810 (L), *Whitmore FRI* 12061 (L), *FRI* 12102 (L, SING). PAHANG: G. Tahan, *Corner*, September 12, 1937 (L), *Holttum SF* 20719 (w), *Ridley* 16042 (κ, holotype of *Terminthodia viridiflora* Ridley), *Soepadmo* 952 (L); Cameron Highlands, *Batten-Pooll*, November, 1939–January, 1940 (SING), *Carrier CF* 27313 (SING), *Henderson SF* 23553 (BO, NY, SING); Ng *FRI* 5899 (L, SING), *Nur SF* 32566 (A, L, SING); G. Tapis, *Cockburn FRI* 10990 (L, SING); Fraser's Hill, *Corner*, August 10, 1937 (SING), Ng *FRI* 5589 (A, L, SING), *Nur SF* 11328 (BO, SING, UC). SELANGOR: Telok Forest Reserve, *Kochummen FRI* 2655 (L, SING). JOHORE: Pontian, Pengkalan Raja, *Ngadiman SF* 36634 (SING); G. Ledang (Mt. Ophir), *Whitmore FRI* 12367 (L), *FRI* 12374 (L); G. Belumut, *Holttum* 65 (SING), 81 (SING), *SF* 10827 (BO, isotype of *Tetractomia holttumii* Ridley); Ayer Hitam Forest Reserve, Ng *KEP* 100002 (A, L, LAE, SING); Mawai-Jemulang Rd., Sg. Kayu, *Corner SF* 28725 (BO, SING), *SF* 28726 (BO, SING), *SF* 28727 (BO, SING); Mawai, *Ngadiman SF* 36797 (A, SING); G. Panti, *Chew* 723 (L, SING). P. PENANG: *Curtis* 281 (κ, SING), *Fox*, July 23, 1905 (BO), *Henderson SF* 21432 (SING), *SF* 35756 (SING), *Roxburgh Icones* 1411 (κ, lectotype of *Melicope tetrandra* Roxb.), *Kiah SF* 35335 (A, BO, SING), *King's Collector* 1798 (κ), 4858 (w), *Kunstler [King's Collector]* 4858 (A), *Nauen SF* 37659 (A, BO, SING), *Symington* 28039 (SING). MALAYA, without definite locality: *Scortechini* (DD, κ, L, MEL, SING, US, w). Singapore: *Lobb* (κ, holotype of *Evodia pedunculosa* Hooker f.), *Maingay Kew Distribution No.* 278/2 (κ). Sumatra. RES. ATJEH (all from G. Leuser Nature Reserve): G. Ketambe & vicinity, *deWilde & deWilde-Duyfjes* 13751 (L), 13997 (L), 14059 (L); G. Bandahara, *deWilde & deWilde-Duyfjes* 13105 (L), 13353 (L). RIAU: Bila River, *Lörzing* 14259 (L); Inderagiri, Kuala Belilas, *Buwalda* 6769 (A, BRI, L, LAE). RIAU-LINGGA ARCHIPELAGO: Lingga, *Anonymous bb* 5591 (BO, L). Borneo. Sarawak. 1ST DIVISION: Sampadi Forest Reserve, *Sinclair & Kadim* 10403 (L, SING); Mt. Bongo [Bungo] near Tegora, *Haviland* 2050 (κ, holotype of *Tetractomia montanum* Ridley); Bungo Range, Bau, *Ilias [bin] Paie & Mamit S* 29036 (L); Kuching & vicinity, *Haviland* 2140 (κ, holotype of *Tetractomia latifolium* Ridley), 2243 (κ, holotype of *Tetractomia parviflorum* Ridley; L, isotype), 2842 (κ), February 3, 1893 (p, w), February 27, 1893 (κ), March 21, 1893 (BO), April 14, 1893 (BO, L), *Haviland & Hose* 3358K (κ), 3359 (κ), December 17, 1894 (L), *Hewitt* (BO), *Zehnder S* 21598 (L, SING); Stapok, *Brunig S* 17522 (L); Semengoh Forest Reserve Arboretum, *Anderson S* 12578 (L, SING), *Banyeng ak Nudong & Sibat ak Luang S* 26224 (L), *Galau S* 15050 (L), *S* 15743 (L, SING), *Haji Bujang S* 32546 (L, SING), *Jugah ak Kudi (Tree No. 2772)* (MEL, SING), *S* 14919 (L, MEL), *S* 15792 (A, L), *Othman Ismawi S* 32969 (L, SING), *Rosli S* 14993 (L, SING), *Zen (Arb. No. 966)* (BO, L, SING); Mt. Penrissen, *Jacobs* 5012 (CANB); Bako National Park, *Anderson* 9766 (BO, L, SING), *Brunig S* 7667 (L, SING), *S* 7689 (L), *S* 7694 (SING), *Carrick & Kassim* 500 (SING), *Corner & Brunig S* 10489 (L), *Ilias [bin] Paie S* 17906 (A, L, SING), *Purseglove* 4940 (L, NY, SING), *Shah P* 5648 (L, NY, SING), *Tan SAR* 28803 (SING). 2ND DIVISION: Sg. Tusak, *Anderson S* 3189 (SING); 1.4 km. from Tanjong Triso, *Anderson* 9792 (BO, L, SING); Lingga, *Anderson* 9825 (L, SING); Saribas Forest Reserve, *Anderson* 8504 (L, SING); Sg. Eutulang, *Anderson* 13106 (L, SING). 3RD DIVISION: Surongirit, *Sanusi bin Tahi* 5210 (BO, L, SING); Loba Kabang Protected Forest, *Anderson S* 2667 (SING); Naman Forest Reserve, *Bojeng bin Sitam S* 13801 (BO, L), *Hamdi S* 27820 (A), *Turkey bin Tran S* 27820 (L); Balingian, Ulu Sg. Arip, Bukit Iju, *Jugah ak Kudi S* 23675 (A, L); Kapit, *Ilias [bin]*

Paie S 25828 (L, SING). 4TH DIVISION: Sg. Segan, *Brunig S 12038* (L); Penyelam, *Brunig S 8684* (L); Baram, *Anderson S 3258* (SING); Marudi Forest Reserve, *Yacup S 8264* (L, SING). SARAWAK, without definite locality: *Anderson S 2630* (SING), *Beccari 1880* (K, holotype of *Tetractomia beccarii* Hooker f.), *Brunig S 8869* (L). **Brunei:** G. Pagon Periok, *Ashton BRUN 2393* (K, L). **Kalimantan.** KALIMANTAN BARAT: G. Kelam, *Hallier 2362* (BO), *2431* (BO, L). KALIMANTAN TENGAH: Sampit District, Koealawajan, *Kostermans 8030* (CANB, SING); Sampit & vicinity, *Buwalda 7659* (BO, L), *7680* (BO, L), *7699* (BO, L), *7704* (BO, L), *7710* (BO), *7718* (BO), *7758* (BO, L), *7760* (BO, L), *7819* (BO, L), *Delmaar bb 2081* (BO), *Hackenbergh 129* (B), *Kostermans 8133* (BO, L), *8155* (A, BO, L); without definite locality, *Winkler 3309* (L). KALIMANTAN TIMUR (all from West Kutei): Mt. Palimasan, on Belajan River near Tabang, *Kostermans 12721* (L), *12951A* (L), *12982* (L, SING), *13064* (L); Kowlindjan River near Melan, *Kostermans 9603* (BO, L). KARIMATA ISLAND: *Teysmann 11235* (BO). **Sabah:** Mt. Kinabalu, *Chew & Corner RSNB 4602* (K, SING), *Chew, Corner, & Stainton RSNB 265* (CANB, K, SING), *Clemens 11025* (A, isotype of *Tetractomia obovatum* Merr.), *J. & M. S. Clemens 32401* (BO, NY), *32558* (BO, L, NY, UC), *32745* (K, L, NY, UC), *33067* (L, NY, UC), *33104* (BO), *50245* (K, L, NY, UC), *50507* (K, L, NY, UC); G. Alab, *Nooteboom 969* (L); Beluran District, G. Tonsuon, *Jilimin & Kapis bin Sisiron SAN 17256* (L); Tambunan District, Crocker Range, *Chow & Aban SAN 65037* (L); *James & Aban SAN 65010* (L); Lahad Datu District, Mt. Silam, *Wood SAN A 4175* (L, SING). **Philippines.** SAMAR: Concord, *Sulit PNH 6330* (A); Mt. Calbiga, *Sulit PNH 6447* (L). BILIRAN: Mt. Suiro, *Sulit PNH 21619* (K, L), *PNH 21699* (L), *PNH 21706* (L). LEYTE: Mt. Dagami, *Ramos BS 15280* (P, US). DINAGAT: *Ponce FB 26985* (K, P, US, isotypes of *Tetractomia pachyphyllum* Merr.), *Ramos & Convozar BS 83821* (NY), *BS 83826* (NY), *BS 83906* (NY). BUCAS GRANDE: *Ramos & Pascasio BS 35106* (A, K), *BS 35135* (A, isotype of *Tetractomia acuminatum* Merr.). MINDANAO: Surigao Province, northeast coast, *Ramos & Pascasio BS 34707* (K, US); Agusan Province, Cabadbaran (Mt. Urdaneta), *Elmer 13702* (BISH, BO, CAL, GH, K, L, NSW, NY, U, US, W, isosyntypes of *Tetractomia philippinense* Elmer), *13751* (BISH, GH, K, L, NSW, NY, U, US, W, isosyntypes of *Tetractomia philippinense* Elmer). **Celebes:** Lombok, *Steup bb 15022* (BO); between Lake Lindoe and Mt. Ngilalaki, *Bloembergen 3944* (BO, L, SING); Lake Poso, *Steup bb 14901* (BO); Masamba, Kaladoe, *Anonymous bb 24168* (A, BO, L); Malili, Oesoe, *Anonymous Cel II-147*, September 12, 1934 (A, BO), *Cel II-321*, February, 1931 (L), *Cel II-321*, October 12, 1931 (BO), *Cel II-321*, October 29, 1931 (BO), *Cel II-381*, July 13, 1931 (BO), *Cel II-483*, January 20, 1931 (BO, L), *Cel III-109*, April 5, 1934 (A, BO); Malili, Waroe Waroe, *Kjellberg 2076* (BO). **Moluccas.** MOROTAI: G. Pare Pare, *Kostermans 1152* (BO, L, SING), *1207* (BO, L, LAE, SING), *1235* (L, LAE, SING); without definite locality, *Kostermans 1310* (BO, L, LAE, SING). CERAM (western): Sahoeai, *Eyma 3003* (BO, L). AMBON: Waai, Mt. Salahutu, *Eyma 3061* (BO, L), *Kuswata & Soepadmo 299* (BO, L, LAE, SING). **Papuasias.** Irian Jaya: near Fakfak, *Pleyte 1083* (BO, L); Babo, *Anonymous bb 22300* (A, BISH, L, NY, SING); Arfak Mts., Angi Lakes, *Kostermans 2454* (BO, L, SING); Wissel Lake region, *Eyma 4784* (L), *4956* (BO, L), *5229* (BO, L), *5287* (BO, L), *5368* (BO, L), *Versteegh BW 3075* (CANB); Utaqua River, Camp VIb, *Kloss (Wollaston Expedition)*, 1913 (K, isosyntytype of *Terminthodia oppositifolia* Ridley); Utaqua River, Camp VIc, *Kloss (Wollaston Expedition)*, 1913 (K, isosyntytype of *Terminthodia oppositifolia* Ridley); Rouffaer River, *Docters van Leeuwen 10421* (BO, L, SING); Idenburg River, vicinity of Bernhard Camp, *Brass 12016* (BO, L, LAE), *12134* (BO, L, LAE), *12172* (L, LAE), *12192* (L), *12454* (L, LAE, isotypes of *Tetractomia lauterbachianum*

forma *pumilum* Merr. & Perry), Brass & Versteegh 11197 (BO, L, LAE); Mt. Doorman, Lam 1451 (L, isotype of *Terminthodia orbiculata* Markgr.), 1627 (L), 1749 (L); Mt. Treub, Pulle 1071 (BO, L, isotypes of *Terminthodia treubiana* Lauterb.); Cycloop Mts., Koster BW 4278 (CANB, SING), BW 4295 (BO, CANB), van Royen & Sleumer 5838 (A, CANB, L, LAE), 6564 (A, L, LAE); Tablanoesoe, van Royen & Sleumer 6482 (CANB); Hollandia & vicinity, Gjellerup 589 (L, isosyntytype of *Terminthodia obovata* Lauterb.), Kostermans & Soegeng 38 (L), 445 (L), Versteegh BW 3916 (BO, CANB, SING); Japen Island, Subdivision Seroei, Anonymous bb 30488 (A, BO, L, SING), Iwanggin BW 10020 (CANB, L, LAE), BW 10073 (L, LAE), Schram BW 10566 (L, LAE); without definite locality, Anonymous bb 22323 (BO, L, SING). **Papua New Guinea.** SEPIK DISTRICT: Aitape Subdistrict, near Wantipi Village (on Bliiri River), Darbyshire & Hoogland 8366 (CANB); Lordberg, Ledermann 9914 (L, isotype of *Terminthodia lanceolata* Lauterb.); Mt. Hunstein, Ledermann 11436 (WRSL, isotype of *Euodia leucantha* Lauterb.); Telefomin Subdistrict, Oksapmin & vicinity, Henty, Isgar, & Galore NGF 41630 (CANB, SING), NGF 41703 (CANB); without definite locality, Ledermann 9397 (L). WESTERN HIGHLANDS DISTRICT: Lake Kopiago, Galore & Vandenberg NGF 41081 (CANB). EASTERN HIGHLANDS DISTRICT: near Wanatabi, about 24 km. southwest of Okapa, Hartley 13150 (CANB). MOROBE DISTRICT: Markham Point, Henty NGF 16757 (CANB), Stauffer, Henty, & Whitmore 5548 (A, CANB, K, LAE); Wagau, Womersley NGF 17824 (BO, CANB, SING); Dschischungari, Schlechter 19588 (P, isosyntytype of *Terminthodia obovata* Lauterb.). WESTERN DISTRICT: Berlin, Ok Tedi River, Foreman & Galore NGF 45785 (CANB), NGF 45788 (CANB); near Ingembit Village, Henty, Ridsdale, & Galore NGF 31809 (CANB, SING). CENTRAL DISTRICT: Kokoda Trail at Ower's Corner, Hartley 10682 (LAE). **Solomon Islands.** NEW GEORGIA GROUP: Vangunu Island, inland from Merusu Islet, Whitmore BSIP 1213 (L, LAE, SING).

It appears to be necessary to lectotypify *Melicope tetrandra* Roxb., the basionym of this species, with the Roxburgh drawing held at Kew. I have not seen a representative Roxburgh collection, and there does not seem to be one either at Kew or at the British Museum (John Maconochie, pers. comm.).

In his description and drawing of *Melicope tetrandra*, Roxburgh did not characterize the seed as being winged, and he stated that all but the apex of the seed was enveloped in an orange-colored, fleshy aril. Perhaps the seed of fresh follicles that are very young or galled (as they sometimes are) might be interpreted in this way, or perhaps Roxburgh's material was mixed. In any case, his description and drawing otherwise clearly represent the Malayan plant interpreted here as the generalized form of *Tetractomia tetrandrum*.

Stone, in Whitmore's *Tree Flora of Malaya* (1: 385. 1972), stated that *Tetractomia tetrandrum* occurs in Burma. I have not seen any collections of it from that country.

The plants here included in *Tetractomia tetrandrum*, while very homogeneous in basic structure of vegetative and reproductive organs, are extremely variable in habit, leaf size and shape, inflorescence size, and flower and fruit size. The general pattern of this variation seems to be characterized by a widespread, generalized form of the species and several local, specialized forms (here referred to as races). This pattern seems to re-

flect the distribution of certain habitats in Malesia: the generalized form occurs mainly in tall, well-drained rain forests at lower and middle elevations, a widespread and common habitat in the region, whereas the specialized forms occur in habitats that are less common and less continuous, for example, lowland peat swamps and heath forests, and high mountain stunted forests and shrubberies.

This, however, is an over-simplification of the actual variability. Plants of the generalized form vary considerably in different parts of the range, even when growing in equivalent habitats. Also, they are not necessarily restricted in habitat preference, and intergrade locally with certain specialized forms. Intergradation also occurs *between* certain specialized forms. As a result, not one of the entities is distinct when considered in the context of all of the material of the species.

Locally distinct (or nearly distinct or otherwise noteworthy) entities do occur, however, and such workers as field botanists and foresters may find it desirable to be able to identify them. In an attempt to accommodate the needs of these people, I have prepared a geographically arranged outline of the variability within the species, with descriptions, notes on distribution, and names of relevant previously described taxa provided for the entities occurring in each region. In order to provide documentation and to facilitate identification of duplicates of the collections cited, the various entities are given letter designations (1a, 1b, etc.), which are used in the Index to Exsiccatae to refer to relevant collections. Altogether, eight entities are recognized:

The generalized form; throughout the range of the species: 1a.

Specialized forms:

- 1b. Malaya mountain race.
- 1c. Peat swamp race; Malaya, Sumatra, and Borneo.
- 1d. Dipterocarp forest race; Borneo.
- 1e. Heath forest race; Borneo.
- 1f. Borneo mountain race.
- 1g. Mossy forest race; Philippines.
- 1h. New Guinea mountain race.

MALAY PENINSULA

1a. The generalized form. Small to large tree. Leaves 8.5–21 cm. long; petiole 1–3.5 cm. long; blade obovate or occasionally oblanceolate or elliptic. Inflorescences many flowered, (6.5–)9–17(–19) cm. long, usually longer than the subtending leaves. Petals green to yellow to white, 1.3–2 mm. long. Follicles glabrous, 5–7.5 mm. long.

DISTRIBUTION. Southern Peninsular Thailand south to Singapore; lowland, foothill, and lower montane forests and borders; sea level to about 1500 meters; apparently restricted to well-drained sites.

Included are the types of *Tetractomia tetrandrum* (Roxb.) Merr. and *Evodia pedunculosa* Hooker f.

Intergrades with the Malaya mountain race (see below).

1b. Malaya mountain race. Shrub or small tree. Leaves 3.1–10 cm. long; petiole 0.3–1 cm. long; blade obovate to suborbicular. Inflorescences several- to many-flowered, 3.5–7 cm. long, about as long as or longer than the subtending leaves. Petals green, 1.7 mm. long. Follicles glabrous, 4.5–6 mm. long.

DISTRIBUTION. Kelantan (G. Rabong), Pahang (G. Tahan), and Johore (G. Belumut); montane forests and open places; 900–2100 meters.

Included are the type collections of *Terminthodia viridiflora* Ridley and *Tetractomia holttumii* Ridley.

A complete range of intermediates between the generalized form and the Malaya mountain race exists in Malayan forests between 900 and 1400 meters, and it is evident that the latter is merely a high mountain extreme of the former. The intermediate collections are referred to in the Index to Exsiccatae as 1a-1b.

1c. Peat swamp race. Medium tree. Leaves 8–23 cm. long; petiole 1–3.5 cm. long; blade obovate or occasionally broadly elliptic. Inflorescences few- to many-flowered, 5–11(–14.5) cm. long, shorter than the subtending leaves. Petals green, 1.3–1.5 mm. long. Follicles glabrous or glabrate, about 5 mm. long.

DISTRIBUTION. Perak, Selangor, and Johore; apparently restricted to lowland peat swamps.

The peat swamp race is reasonably distinct from the generalized form in the Malay Peninsula in having inflorescences shorter than the subtending leaves and a tendency toward smaller petals and follicles. From the data available, it also appears that here the two are ecologically distinct.

The carpels in flower and the young follicles vary from glabrous to sparsely pubescent in this entity, a character that appears to be insignificant. Such pubescence is also of sporadic occurrence in plants of the generalized form from Borneo, Celebes, and the Moluccas.

SUMATRA

1a. Generalized form. Medium tree. Leaves 12–20 cm. long; petiole 1.5–4 cm. long; blade obovate. Inflorescences several flowered, 12–17 cm. long, about as long as or longer than the subtending leaves. Petals 2 mm. long. Follicles glabrous, 7–8 mm. long.

DISTRIBUTION. Lingga; lowland peat swamp.

The collections made by deWilde and deWilde-Duyfjes from northern Sumatra (G. Leuser Nature Reserve, montane forests and open areas, 1500–2000 meters) quite closely match some of the Malayan specimens considered to be intermediate between the Malay Peninsula generalized form and the Malaya mountain race. These Sumatran collections are referred to in the Index to Exsiccatae as 1a-1b.

1c. *Peat swamp race*. Tree. Leaves 10.5–17 cm. long; petiole 2–2.5 cm. long; blade obovate to oblanceolate. Inflorescences several- to many-flowered, 5–7 cm. long, shorter than the subtending leaves. Petals greenish yellow, 1 mm. long. Follicles glabrate, 5–5.5 mm. long.

DISTRIBUTION. Riau; low elevation; recorded from a swampy forest.

BORNEO

1a. *Generalized form*. Small to large tree. Leaves 7.5–22(–32) cm. long; petiole 0.8–5 cm. long; blade obovate to oblanceolate or elliptic. Inflorescences few- to many-flowered, 4–16 cm. long, usually longer than the subtending leaves. Petals green, 1.8–2.5 mm. long. Follicles glabrous or glabrate, (3.5–)5–9 mm. long.

DISTRIBUTION. Sarawak, Kalimantan, and Sabah; lowland peat swamps and well-drained forests, borders, and open places; sea level to 1860 meters.

Included is the type collection of *Tetractomia latifolium* Ridley.

1c. *Peat swamp race*. Small to medium tree. Leaves 6–17 cm. long; petiole 1–3.5 cm. long; blade obovate or occasionally grading toward sub-orbicular or oblanceolate. Inflorescences few- to many-flowered, 2–8 cm. long, shorter than the subtending leaves. Petals green to yellowish, 1 mm. long. Follicles glabrous, about 5 mm. long.

DISTRIBUTION. Sarawak and Kalimantan; apparently restricted to lowland peat swamps.

Included is the type collection of *Tetractomia parviflorum* Ridley.

In Borneo, the peat swamp race and the generalized form are distinct in petal size, and usually in inflorescence size as well. Surprisingly, the two apparently grow together in peat swamps in the vicinities of Kuching and Sampit.

1d. *Dipterocarp forest race*. Medium tree. Leaves 7.5–16.5 cm. long; petiole 1–3.4 cm. long; blade obovate or occasionally oblanceolate. Inflorescences few- to several-flowered, 4.5–10.5 cm. long, shorter than the subtending leaves. Petals greenish, 3–4.5 mm. long. Follicles glabrous, 8.5–11 mm. long.

DISTRIBUTION. Sarawak; usually in lowland dipterocarp forests; one collection (*Sinclair & Kadim 10403*) from heath forest (kerangas) at low elevation.

Included is the type collection of *Tetractomia beccarii* Hooker f.

The dipterocarp forest race is very similar in leaf to several of the Borneo specimens of the generalized form, especially those from Bako National Park. The petals and follicles of the dipterocarp forest race are consistently larger, however.

Intergradation occurs between the dipterocarp forest race and the heath forest race (see text below and FIGURE 1).

1e. Heath forest race. Small tree. Leaves 2.5–5.3 cm. long; petiole 0.35–0.45 cm. long; blade obovate to oblanceolate. Inflorescences 1- to 3-flowered, 0.8–1.5 cm. long, shorter than the subtending leaves. Petals green, 3.5 mm. long. Follicles glabrous, about 7 mm. long.

DISTRIBUTION. Sarawak (Bungo Range); recorded from heath forest at about 780 meters.

Included is the type collection of *Tetractomia montanum* Ridley.

The extreme reduction in leaf and inflorescence sizes in the heath forest race is likely the result of adaptation more to edaphic conditions than to high elevation; the two collections of this race (*Haviland 2050* and *Ilias Paie & Mamit S 29036*) were probably both made from sandstone heath forests, and the maximum elevation of the Bungo Range is only 980 meters.

Four collections from heath forests and rather open, sandy areas (all from rather low elevations) in Bako National Park appear to be more or less intermediate between the dipterocarp forest and the heath forest races. These collections are referred to in the Index to Exsiccatae as 1d-1e.

The intergradation of leaf characteristics between the dipterocarp forest and the heath forest races is illustrated in FIGURE 1.

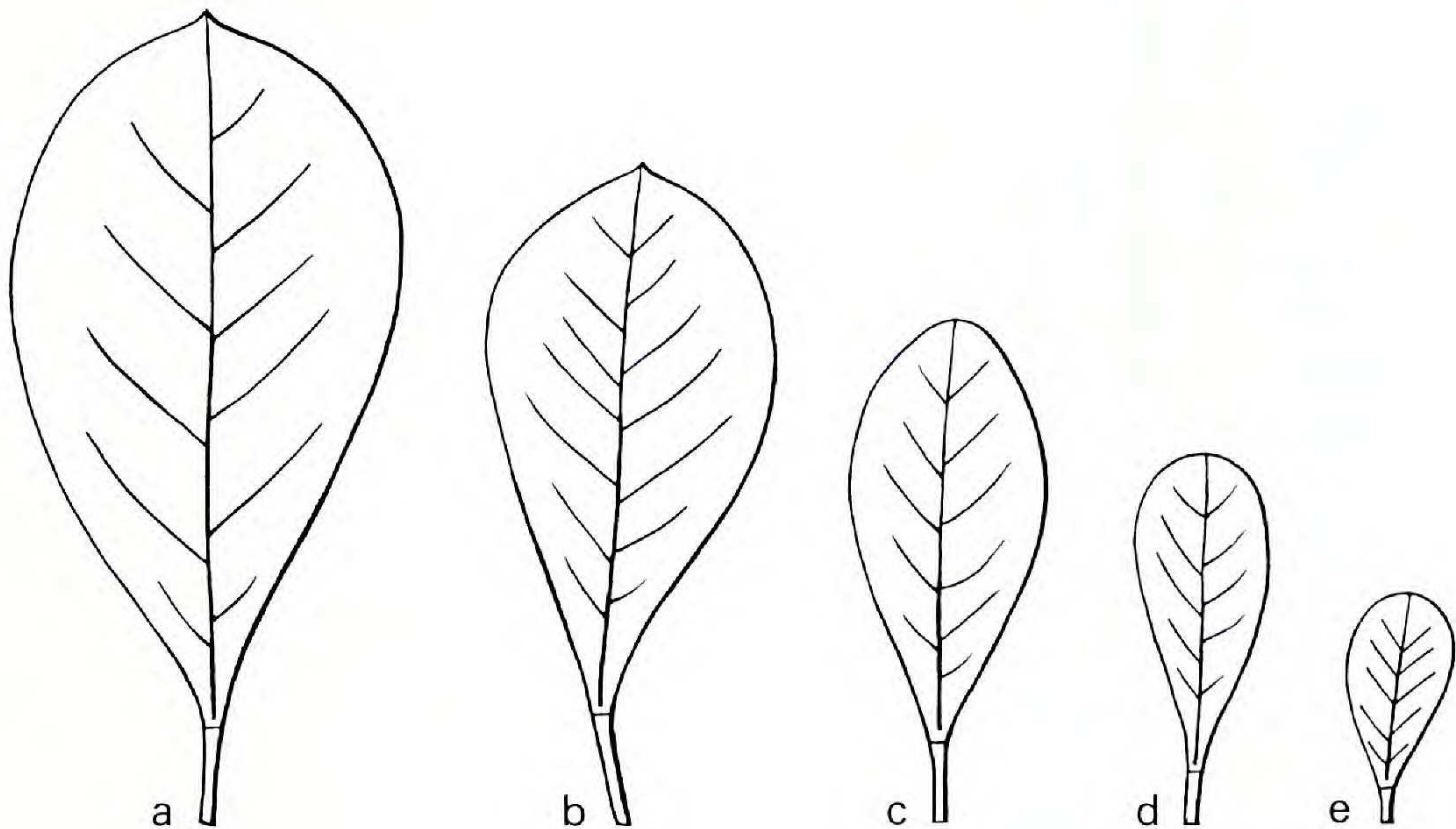


FIGURE 1. Leaf variability in *Tetractomia tetrandrum* (Roxb.) Merr. Intergradation between the dipterocarp forest race (a) and the heath forest race (e): a, *Banyeng ak Nudong & Sibat ak Luang S 26224*, from lowland dipterocarp forest, Semengoh Forest Reserve, Sarawak; b, *Jugah ak Kudi S 15792*, from dipterocarp forest at 90 meters, Semengoh Forest Reserve, Sarawak; c, *Shah P 5648*, from open sandstone summit at 210 meters, Bako National Park, Sarawak; d, *Corner & Brunig S 10489*, from open sandstone area at 150 meters, Bako National Park, Sarawak; e, *Ilias [bin] Paie & Mamit S 29036*, from sandstone heath forest at 780 meters, Bungo Range, Sarawak. (All $\times \frac{1}{2}$.)

1f. *Borneo mountain race*. Shrub or small to medium tree. Leaves 2.9–14.5 cm. long; petiole 0.3–1.5 cm. long; blade obovate to suborbicular or occasionally oblanceolate. Inflorescences few flowered, 3–8.5 cm. long, usually shorter than the subtending leaves. Petals green, greenish white, or green tinged with purple, 2.5–4 mm. long. Follicles glabrous, 5.5–7 mm. long.

DISTRIBUTION. Brunei and Sabah; lower montane forests, borders, and open places; 810–1830 meters.

Included is the type collection of *Tetractomia obovatum* Merr.

Although obviously just a lower montane extreme of the generally more lowland generalized form, the Borneo mountain race is more or less distinct from that entity in Borneo when leaf size, number of flowers per inflorescence, and petal size are considered in combination. More collections from intermediate habitats would probably show that the two intergrade completely.

Although considerably out of range, a single sterile collection from Karimata Island (*Teysmann 11235*), which has broadly obovate to suborbicular leaves, may belong to this race.

PHILIPPINES

1a. *Generalized form*. Shrub or small to medium tree. Leaves 8–17.5 cm. long; petiole 1–3.7 cm. long; blade obovate to oblanceolate or occasionally elliptic. Inflorescences several- to many-flowered, 9–19 cm. long, usually longer than the subtending leaves. Petals greenish yellow, 2–3.5 mm. long. Follicles glabrous, 4.5–5 mm. long.

DISTRIBUTION. Samar, Dinagat, Bucas Grande, and Mindanao; forests and borders, sea level to about 350 meters.

Included are the type collections of *Tetractomia pachyphyllum* Merr. and *T. acuminatum* Merr.

Intergrades with the mossy forest race (see below).

1g. *Mossy forest race*. Shrub or small tree. Leaves 4–8 cm. long; petiole 0.6–1.5 cm. long; blade obovate to oblanceolate. Inflorescences few flowered, 2–4 cm. long, shorter than the subtending leaves. Petals 1.3 mm. long. Follicles glabrous, 2.5 mm. long.

DISTRIBUTION. Mindanao (Mt. Urdaneta); mossy ridge, 1650–1725 meters.

Represented solely by the two syntype collections of *Tetractomia philippinense* Elmer.

Four Philippine collections (three from Biliran and one from Leyte; mossy forests, 900–1350 meters) appear to be more or less intermediate between the Philippine material of the generalized form and the mossy forest race. They are referred to in the Index to Exsiccatae as 1a-1g.

CELEBES

1a. *Generalized form. Medium to rather large tree. Leaves 6–18 cm. long; petiole 1–3 cm. long; blade obovate to oblanceolate. Inflorescences several- to many-flowered, 5–16 cm. long, shorter than to longer than the subtending leaves. Petals 1–1.5 mm. long. Follicles glabrous or glabrate, 5–7 mm. long.*

DISTRIBUTION. Minahassa Peninsula, central region, and southeastern peninsula; forests (apparently often swampy); sea level to about 2000 meters.

The Celebes plants seem more or less to combine characteristics of the Malay Peninsula-Sumatra-Borneo-Philippines material of the generalized form and the peat swamp race: in inflorescence length they tend to be more like the former, while in petal size they seem more nearly to match the latter.

MOLUCCAS

1a. *Generalized form. Small to rather large tree. Leaves 6–14.5 cm. long; petiole 1.2–3.5 cm. long; blade obovate to oblanceolate. Inflorescences several flowered, 2–7 cm. long, usually shorter than the subtending leaves. Petals 1.5–2 mm. long. Follicles glabrous or rarely glabrate, 2–4 mm. long.*

DISTRIBUTION. Morotai, Ceram, and Ambon; recorded from well-drained forests; sea level to about 1000 meters.

As is the case in the Celebes, the Moluccan plants of *Tetractomia tetrandrum* seem to combine characteristics of the western Malesian material of the generalized form and the peat swamp race. Here, however, the characteristics are combined in a way that is just the reverse of the way they were combined in the Celebes; in petal size the Moluccan plants resemble the generalized form, while in inflorescence size they are more like the peat swamp race.

PAPUASIA

1a. *Generalized form. Small to large tree. Leaves 4.7–17.5 cm. long; petiole 0.6–3 cm. long; blade obovate to oblanceolate to elliptic or (rarely) suborbicular. Inflorescences few- to many-flowered, 2–13 cm. long, shorter than to longer than the subtending leaves. Petals white to green to pale yellow (in one collection white with pink flush), 1–2 mm. long. Follicles glabrous, 3.5–5 mm. long.*

DISTRIBUTION. New Guinea and the Solomon Islands; well-drained forests (usually primary); sea level to about 1950 meters.

Included are the type collections of *Terminthodia oppositifolia* Ridley, *Terminthodia obovata* Lauterb. (*Tetractomia lauterbachianum* Merr. &

Perry), *Terminthodia orbiculata* Markgr., *Terminthodia lanceolata* Lauterb., and *Euodia leucantha* Lauterb.

Several collections, for example *Versteegh BW 3916*, *Iwanggin BW 10073*, and *Koster BW 4278*, all from Irian Jaya, and *Darbyshire & Hoogland 8366*, from the Sepik District, very closely match material of the generalized form from western Malesia; several others, including *Versteegh BW 3075* and *Eyma 5229*, both from the Wissel Lake region, and *Henty NGF 16757*, from the Morobe District, are reasonably good matches for the peat swamp race. (None of the Papuan plants, however, seems to show a habitat preference for peat swamps.) Most of the remaining Papuan specimens fall somewhere in between, with the result that here the differential characters of the western Malesian material of the generalized form and the peat swamp race intergrade completely. One remaining specimen, *Lam 1451*, from Mt. Doorman, an isotype of *Terminthodia orbiculata*, stands apart in having unusually large, broadly obovate to suborbicular leaf blades. In other characters, however, this specimen falls within the range of variability of the other material of the Papuan generalized form.

The Papuan generalized form intergrades with the New Guinea mountain race (see text below and FIGURE 2).

1h. New Guinea mountain race. Shrub. Leaves 1.2–5.5 cm. long; petiole 0.1–0.5 cm. long; blade obovate to suborbicular. Inflorescences few flowered, 0.5–2 cm. long, shorter than the subtending leaves. Petals 1.5–2 mm. long. Follicles glabrous, about 4 mm. long.

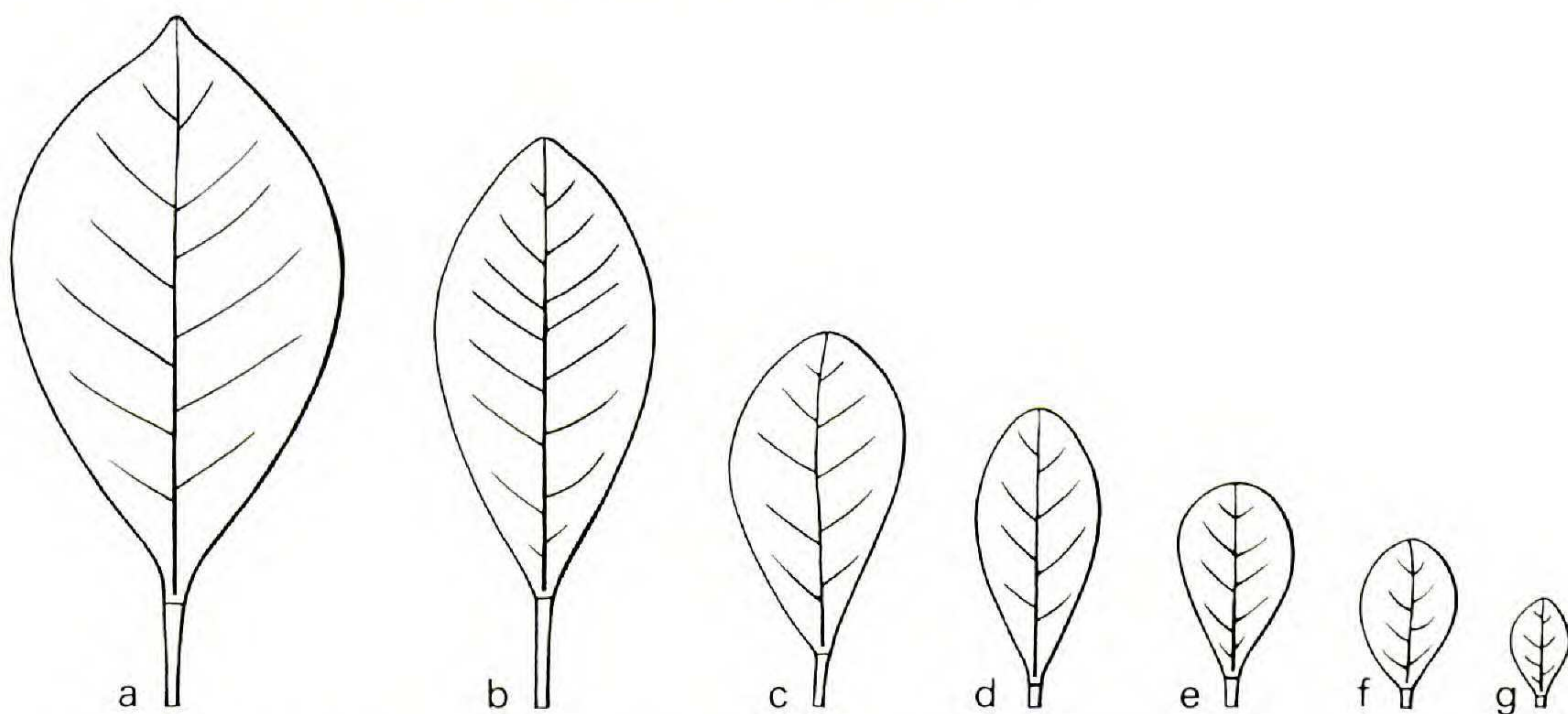


FIGURE 2. Leaf variability in *Tetractomia tetrandrum* (Roxb.) Merr. Intergradation between the New Guinea generalized form (a) and the New Guinea mountain race (g): a, *Darbyshire & Hoogland 8366*, from tall rain forest at 240 meters, Sepik District; b, *Docters van Leeuwen 10421*, from rain forest at 250 meters, Rouffaer River; c, *Brass 12134*, from mossy forest at 1800 meters, Idenburg River; d, *Kostermans 2454*, from mountain summit at 2000 meters, Arfak Mts.; e, *Brass 12192*, from mossy forest at 2100 meters, Idenburg River; f, *Lam 1627*, from subalpine shrubbery at 3300 meters, Mt. Doorman; g, *Lam 1749*, from subalpine shrubbery at 3280 meters, Mt. Doorman. (All $\times 0.4$.)

DISTRIBUTION. Irian Jaya, Wissel Lake region and Mt. Doorman; open, subalpine habitats; about 3300 meters.

A number of specimens from Irian Jaya, including the type collections of *Terminthodia treubiana* Lauterb. and *Tetractomia lauterbachianum* forma *pumilum* Merr. & Perry, constitute a complete range of intermediates between the Papuan generalized form and the New Guinea mountain race, and it is evident that the latter is merely a subalpine extreme of the former (see FIGURE 2). Judging from its original description, *Terminthodia schultzei-leonhardii* Lauterb. may also belong in this intermediate category. I have not seen material of the type collection (*Leonard Schultze 300*, from the Sepik District), which was apparently destroyed at Berlin in World War II.

2. *Tetractomia majus* Hooker f. Fl. Brit. India 1: 491. 1875. TYPE: *Maingay Kew Distribution No. 290*, Malaya, Malacca.

Tetramerista paniculata Kurz, London Jour. Bot. 13: 333. 1875. Based on the type collection of *Tetractomia majus* Hooker f.

Melicope major (Hooker f.) Engler in Engler & Prantl, Nat. Pflanzenfam. III. 4: 122. 1896.

Medium tree 12–15 meters high; branchlets 8–13 mm. in diameter. Leaves 13.5–30.5 cm. long; petiole 2.5–5.5 cm. long, articulated with the blade; blade glabrous or with minute, scattered, ephemeral hairs below, subcoriaceous to coriaceous, obovate to broadly oblanceolate, 11.5–26 cm. long, 6.5–12.5 cm. wide, the base cuneate to attenuate, the apex rounded or occasionally acuminate, the main veins 10 to 12 (to 16) on each side of the midrib. Inflorescences 10–16 cm. long, many flowered, the peduncle glabrate, the rachis and branches sparsely pubescent, the pedicels sparsely pubescent, 5–7 mm. long. Flowers about 9 mm. wide; sepals glabrous to sparsely pubescent, ciliolate when young, becoming eciliate, broadly ovate, about 1.5 mm. long; petals green, glabrous, ovate-triangular, about 4.5 mm. long; stamens with anther about 1 mm. long; gynoecium glabrous, the carpels distinct at the base. Follicles glabrous, distinct, 9–11 mm. long; petals, staminodes, and filaments of stamens persistent in fruit.

DISTRIBUTION. Southern Malaya; lowland peat swamps (see MAP 1).

Malaya. MALACCA: *Maingay Kew Distribution No. 290* (K, holotype of *Tetractomia majus* Hooker f.; L, isotype). JOHORE: Pontian, Pengkalan Raja, *Ngadiman SF 36674* (A), *SF 36684* (SING); Ayer Hitam Forest Reserve, *Kochummen FRI 2148* (L, SING); Sedili Botanic Reserve, *Corner SF 35561* (L, SING).

Tetractomia majus was published in February, 1875; *Tetramerista paniculata*, in November, 1875.

Tetractomia majus is very closely related to *T. tetrandrum*, differing mainly in having thicker branchlets and longer pedicels. The two species (the latter as the peat swamp race) appear to grow together in two localities in Johore.

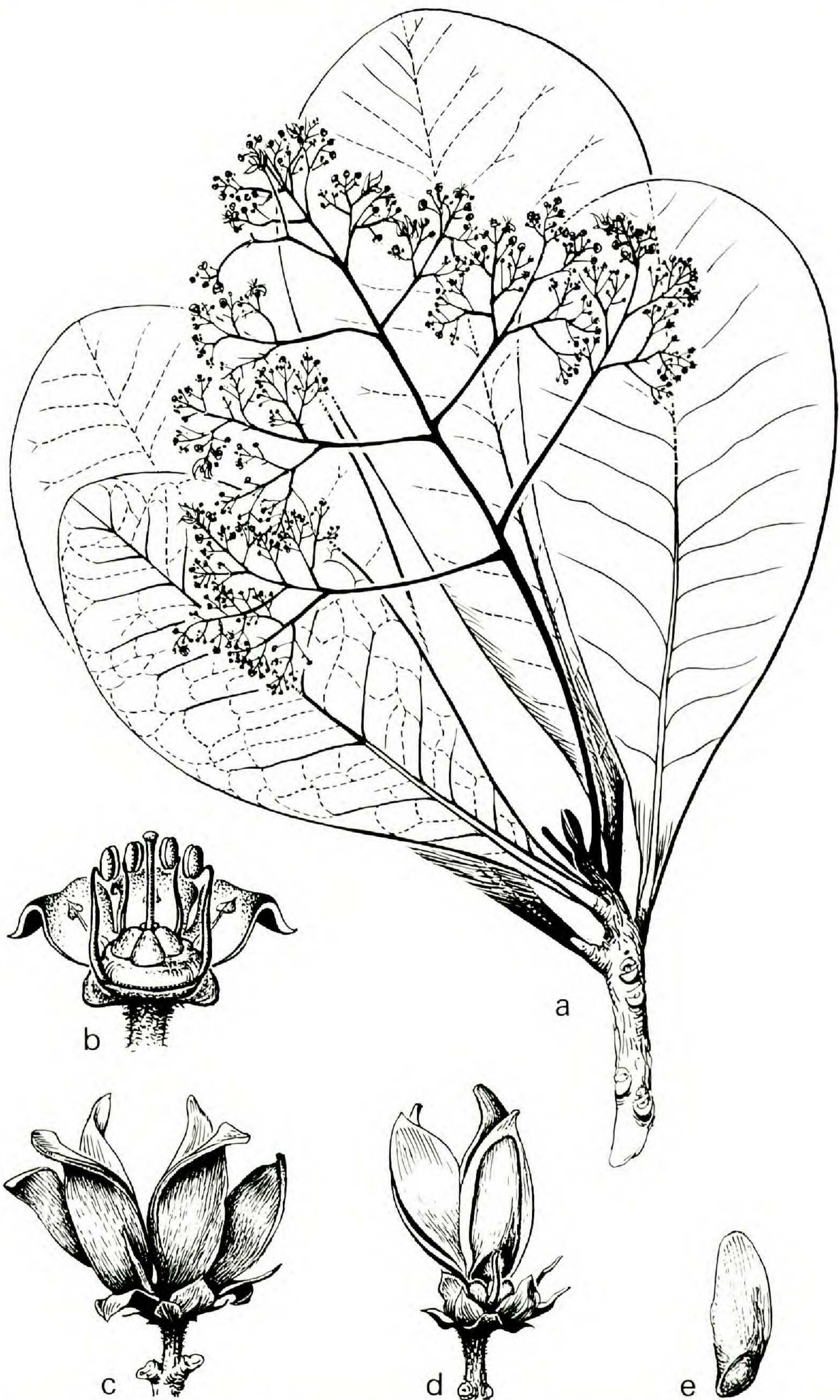


FIGURE 3. *Tetractomia barringtonioides* Hartley: a, fertile branchlet, $\times \frac{1}{2}$; b, flower with one petal removed, $\times 11$; c, fruit in abaxial view, $\times 5$; d, fruit with adaxial view of single follicle containing seed, $\times 5$; e, seed, $\times 5$. (Drawn from *Anonymous CEL II-361*, June 12 to July 13, 1931.)

3. *Tetractomia barringtonioides* Hartley, sp. nov. FIGURE 3.

Arbor mediocris vel magna usque 30 m. alta; ramulis 5–10 mm. latis; foliis 10–25 cm. longis; petiolo obsoleto vel usque 0.7 cm. longo, basi laminae non articulato; lamina glabra, subcoriacea, oblanceolata, 10–25 cm. longa, 4.5–12.5 cm. lata, basi attenuata, apice rotundata vel obtusa, venis primariis utrinsecus costae 8–11; inflorescentiis multifloris, 16–22 cm. longis, pedunculo glabro vel glabrato, rhachidi et ramis sparse vel aliquantum dense pubescentibus, pedicellis sparse vel aliquantum dense pubescentibus, 0.5–1 mm. longis; floribus 2.5–3 mm. latis; sepalis glabris, ovato-triangularibus, 0.5–0.7 mm. longis; petalis albis vel pallide viridibus, glabris, ovato-triangularibus, 1.3–1.5 mm. longis; staminibus anthera ca. 0.5 mm. longa; gynoecio glabro, carpellis basi distinctis; folliculis glabris, distinctis, 5–5.5 mm. longis; petalis, staminodiis, et filamentis staminum in fructu persistentibus. HOLOTYPUS: *Anonymous Cel II-361*, May 28, 1931 (L).

DISTRIBUTION. Celebes, Malili; primary forests; sea level to 200 meters (see MAP 1).

Celebes: Malili, Oesoe, *Anonymous Cel II-361*, May 28, 1931 (L, holotype; BO, K, isotypes), *Cel II-361*, June 12, 1931 (BO), *Cel II-361*, June 12–July 13, 1931 (K, L), *Cel III-30*, October 27, 1931 (BO, L), *Cel III-30*, December 8, 1931 (BO, L), *Cel III-30*, July 8, 1932 (L).

As is noted above, *Tetractomia barringtonioides*, *T. kostermansii*, and *T. rotundifolium* appear to comprise a natural group differing from the other species of the genus in not having an articulation at the base of the leaf blade. Within the group, the three species differ quite significantly (although only quantitatively), and their interrelationships are not particularly clear.

The epithet *barringtonioides* refers to the similarity of the leaves of this species to those of some of the species of *Barringtonia* (Lecythidaceae) (*B. asiatica* (L.) Kurz and *B. calyptrata* (Miers) R. Br. ex F. M. Bailey, for example).

4. *Tetractomia kostermansii* Hartley, sp. nov. FIGURE 4.

Arbor parva 3–5 m. alta; ramulis 4–5 mm. latis; foliis 8–17 cm. longis; petiolo obsoleto vel usque 0.5 cm. longo, basi laminae non articulato; lamina glabra, coriacea, obovata vel oblanceolata, 8–17 cm. longa, 4–7 cm. lata, basi attenuata, apice retusa vel rotundata vel obtusa, venis primariis utrinsecus costae 6–8; inflorescentiis pluri- vel multifloris, 5–7 cm. longis, glabris, pedicellis 1–2 mm. longis; floribus ca. 6 mm. latis; sepalis glabris, late rotundatis vel ovato-triangularibus, 0.8–1 mm. longis; petalis glabris, ovato-triangularibus, 2.5–3 mm. longis; staminibus anthera ca. 0.6 mm. longa; gynoecio glabro, carpellis basi distinctis vel basin versus connatis; folliculis glabris, distinctis vel basin versus connatis, 4–5.5 mm. longis; petalis, staminodiis, et filamentis staminum in fructu persistentibus. HOLOTYPUS: *Kostermans 2192* (L).

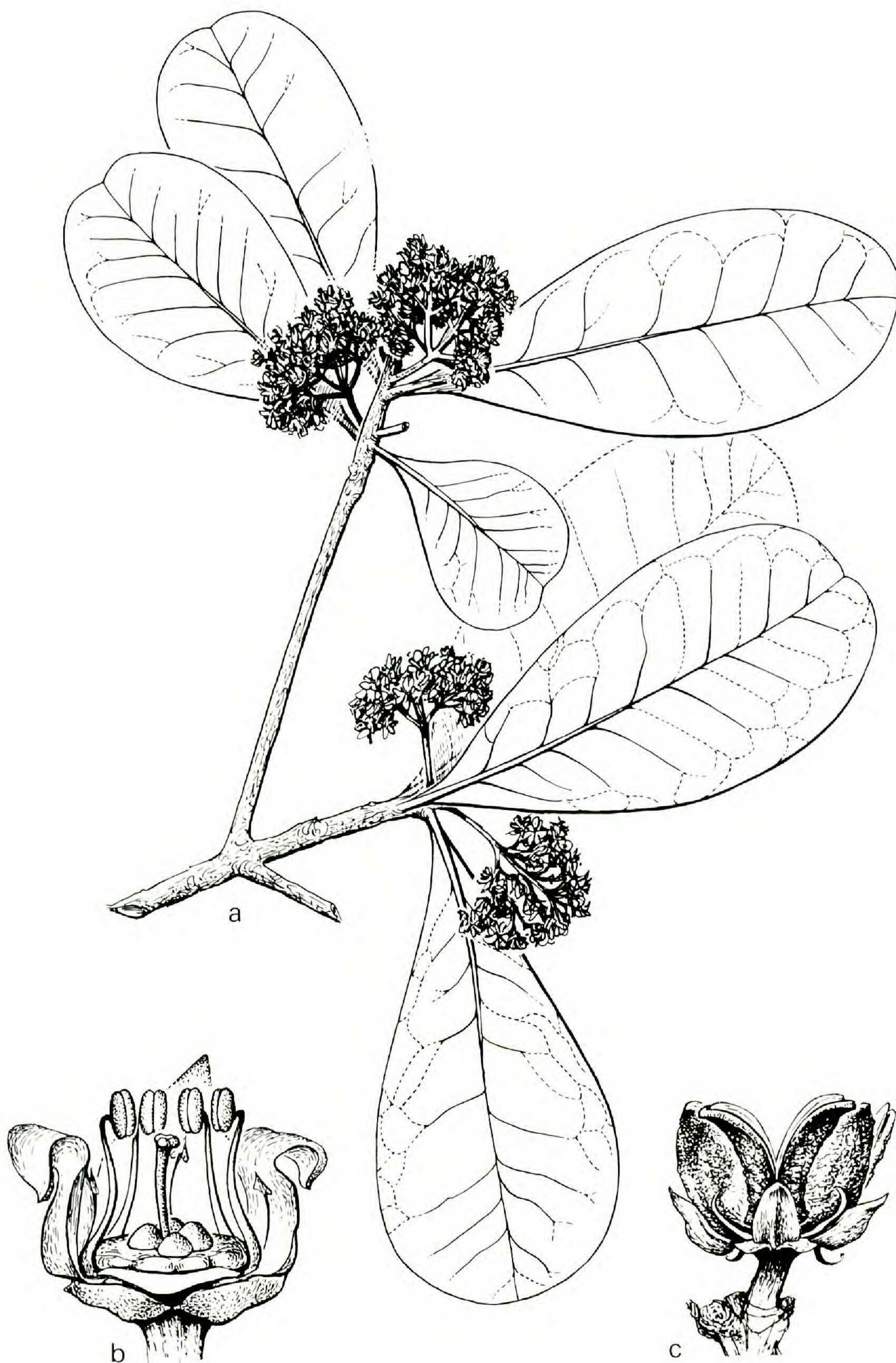


FIGURE 4. *Tetractomia kostermansii* Hartley: a, fertile branchlet, $\times 0.45$; b, flower with one petal removed, $\times 10$; c, fruit, $\times 4.5$. (Drawn from *Kostermans 2418*.)

DISTRIBUTION. Irian Jaya, Vogelkop Peninsula; montane forests; 1800–1850 meters (see MAP 1).

Papuasias. IRIAN JAYA. Vogelkop Peninsula: Nettoti Range, N. slope of Mt. Nettoti, *van Royen & Sleumer 8167* (L); Arfak Mts., Angi Lakes, *Kostermans 2192* (L, holotype; BO, SING, isotypes), *2418* (BO, L, SING).

It is noteworthy that *Tetractomia kostermansii*, *T. rotundifolium*, and *T. tetrandrum* have all been collected in the vicinity of the Angi Lakes. Whether or not all three grow side by side at this locality cannot be determined from the data available, but this seems possible. The collections of *T. kostermansii* were made from forests at 1800 meters, while those of *T. rotundifolium* were made from both forests and open areas from 1900 to 2700 meters. The single collection of *T. tetrandrum* (*Kostermans 2454*, an intermediate between the generalized form and the New Guinea mountain race) was recorded from a mountain summit at 2000 meters (probably an open habitat: Kostermans made other collections of *Tetractomia* on this trip to the Angi Lakes and clearly indicated when the plants were growing in forested habitats), but plants similar to those of Kostermans also grow in montane forests elsewhere in Irian Jaya.

5. *Tetractomia rotundifolium* (Ridley) Merr. & Perry, Jour. Arnold Arb. 22: 54. 1941 (as "*rotundifolia*").

Terminthodia rotundifolia Ridley in Gibbs, Contr. Phytogr. Fl. Arfak Mts. 143. 1917. TYPE: *Gibbs 5653*, Dutch N.W. New Guinea [Irian Jaya], Arfak Mts.

Small to rather tall shrub to about 4 meters high; branchlets 2–3 mm. in diameter. Leaves 2–5.5 cm. long; petiole obsolete to 0.15 cm. long, not articulated with the blade; blade subcoriaceous to coriaceous, suborbicular to obovate to oblanceolate, 2–5.5 cm. long, 1–2.5 cm. wide, the base cuneate to attenuate, the apex rounded to obtuse, the main veins 4 or 5 on each side of the midrib. Inflorescences one- to few-flowered, 0.6–3 cm. long, glabrous or nearly so, the pedicels 1–2 mm. long. Flowers about 5 mm. wide; sepals glabrous, eciliate, triangular, about 1 mm. long; petals glabrous, ovate-triangular, about 2 mm. long; stamens with anther 0.5 mm. long; gynoecium glabrous, the carpels distinct at the base. Follicles glabrous, distinct, about 4 mm. long; petals, staminodes, and filaments of stamens persistent in fruit.

DISTRIBUTION. Irian Jaya, Arfak Mts.; montane forests and open places; 1900–2700 meters (see MAP 1).

Papuasias. IRIAN JAYA. Arfak Mts.: Angi Lakes, *Kanehira & Hatusima 13491* (A, BO), *Kostermans 2462* (BO, L); Angi Lakes, Mt. Koebré, *Gibbs 5653* (K, isotype of *Terminthodia rotundifolia* Ridley), *Kanehira & Hatusima 13703* (A), *14082* (A).

Ridley listed the type of this species as *Gibbs 5652*. This is apparently an error. The type sheet at Kew bears the number *5653*. Also, *Gibbs*

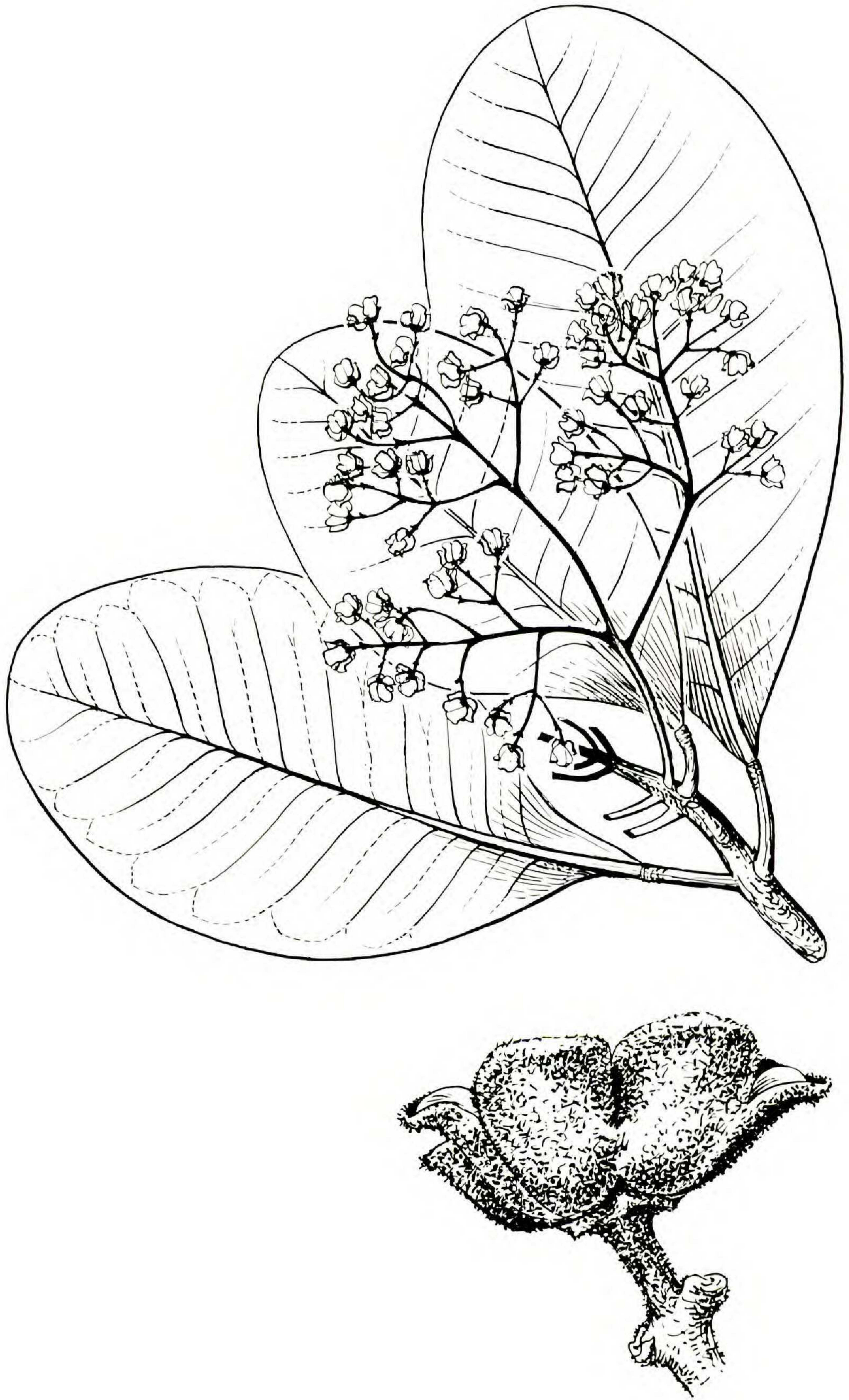


FIGURE 5. *Tetractomia solomonense* Hartley: above, fertile branchlet, $\times 0.7$; below, fruit, $\times 7$. (Drawn from *Gafui & Collectors BSIP 9465*.)

5652 is cited as a syntype of *Microstylis grandiflora* J. J. Sm. in Gibbs's *Contribution to the Phytogeography and Flora of the Arjak Mts.* 111. 1917.

6. *Tetractomia solomonense* Hartley, sp. nov.

FIGURE 5.

Arbor mediocris ca. 12 m. alta; ramulis 5–6 mm. latis; foliis 10–14.5 cm. longis; petiolo 1–1.5 cm. longo, basi laminae articulato; lamina glabra, subcoriacea, subelliptica vel obovata, 9–13 cm. longa, 4.5–7 cm. lata, basi cuneata, apice rotundata, venis primariis utrinsecus costae 9–10; paniculis fructiferis 7–16 cm. longis, pedunculo glabrato, rhachidi et ramis sparse pubescentibus, pedicellis aliquantum dense pubescentibus, 1–4 mm. longis; floribus (descriptio ex parte ex partibus delapsis florum) ca. 3.5 mm. latis; sepalis pubescentibus, triangularibus vel ovato-triangularibus, 0.5 mm. longis; petalis glabris, ovato-triangularibus, 1.5 mm. longis; staminibus anthera ca. 0.5 mm. longa; carpellis dense pubescentibus, basin versus connatis; stylo glabro; folliculis dense farinoso-pubescentibus, basin versus connatis, ca. 3.5 mm. longis; petalis, staminodiis, et filamentis staminum in fructu deciduis. HOLOTYPUS: *Gafui & Collectors BSIP 9465* (κ).

DISTRIBUTION. Known only from the type collection (see MAP 1).

Papuasias. SOLOMON ISLANDS. Eastern Guadalcanal: Makini area, Marau, *Gafui & Collectors BSIP 9465* (κ, holotype; L, LAE, isotypes).

EXCLUDED SPECIES

Melicope (section *Tetractomia*) *lamii* Lauterb. *Nova Guinea* 14: 142. 1924 (as section "Tetractoma"). The two syntypes of this species, *Lam 1841* and *1863*, both from Mt. Doorman, Irian Jaya ("Nova Guinea Neerlandica" on labels), have trifoliolate, or predominantly trifoliolate, leaves and functionally pistillate flowers, each with 8 staminodes. They clearly do not belong in *Tetractomia*, but are probably correctly placed in *Melicope*.

ACKNOWLEDGMENTS

I wish to thank the directors and curators of the herbaria listed in the introduction for making specimens in their care available to me. Thanks are also extended to Tibor Binder, C.S.I.R.O. Division of Plant Industry, who prepared the illustrations, and to John Maconochie, the Australian Botanical Liaison Officer at Kew in 1977, who very helpfully supplied me with information regarding Roxburgh's drawing of *Melicope tetrandra* and Maingay's *Flora of Malacca* manuscript.

INDEX TO EXSICCATAE

The numbers in parentheses refer to the corresponding species in the text. The entities of species number 1, *Tetractomia tetrandrum*, are referred to by letters, following the outline given in the text.

- Anderson *S* 2667 (1a); *S* 2630 (1c);
S 3189 (1a); *S* 3258 (1c); 8504,
 9766 (1a); 9792, 9825 (1c); *S*
 12578 (1d); 13106 (1c).
 Ashton *BRUN* 2393 (1f).
 Banyeng ak Nudong & Sibat ak Lu-
 ang *S* 26224 (1d).
 Beccari 1880 (1d).
 Bloembergen 3944 (1a).
 Bojeng bin Sitam *S* 13801 (1a).
 Bosschen buitengewesten series (*bb*),
 Netherlands Indies Forest Service;
 the following by anonymous collec-
 tors: *bb* 5591, *bb* 22300, *bb* 22323,
bb 24168, *bb* 30488 (1a).
 Brass 12016, 12134, 12172, 12192,
 12454 (1a-1h).
 Brass & Versteegh 11197 (1a-1h).
 Brunig *S* 7667, *S* 7689 (1a); *S* 7694
 (1d); *S* 8684, *S* 8869 (1a); *S* 12038
 (1c); *S* 17522 (1a).
 Burkill & Haniff *SF* 12583 (1a-1b).
 Buwalda 6769, 7659, 7680, 7699 (1c);
 7704, 7710 (1a); 7718, 7758 (1c);
 7760 (1a); 7819 (1c).
 Carrick & Kassim 500 (1a).
 Carrier *CF* 27313 (1a-1b).
 Celebes series, Forest Research Insti-
 tute, Buitenzorg; the following by
 anonymous collectors: *Cel* I-147,
Cel II-321 (1a); *Cel* II-361 (3); *Cel*
 II-381, *Cel* II-483 (1a); *Cel* III-
 30 (3); *Cel* III-109 (1a).
 Chew 723 (1a).
 Chew & Corner *RSNB* 4602 (1f).
 Chew, Corner, & Stainton *RSNB* 265
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 Chow & Aban *SAN* 65037 (1a).
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 Clemens, M. S. 11025 (1f).
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 Corner & Brunig *S* 10489 (1d-1e).
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 Darbyshire & Hoogland 8366 (1a).
 Delmaar *bb* 2081 (1a).
 Docters van Leeuwen 10421 (1a).
 Elmer 13702, 13751 (1g).
 Everett *FRI* 13927 (1a).
 Eyma 3003, 3061 (1a); 4784 (1h);
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 5368 (1a-1h).
 Foreman & Galore *NGF* 45785, *NGF*
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 Gafui & Collectors *BSIP* 9465 (6).
 Galau *S* 15050, *S* 15743 (1d).
 Galore & Vandenberg *NGF* 41081 (1a).
 Gibbs 5653 (5).
 Gjellerup 589 (1a).
 Hackenberg 129 (1c).
 Haja Bujang *S* 32546 (1d).
 Hallier 2362, 2431 (1a).
 Hamdi *S* 27820 (1a).
 Hartley 10682, 13150 (1a).
 Haviland 2050 (1e); 2140 (1a); 2243
 (1c); 2842 (1a).
 Haviland & Hose 3358K, 3359 (1a).
 Henderson *SF* 21432, *SF* 23553, *SF*
 35756 (1a).
 Henty *NGF* 16757 (1a).
 Henty, Isgar, & Galore *NGF* 41630,
NGF 41703 (1a).
 Henty, Ridsdale, & Galore *NGF* 31809
 (1a).
 Holttum 65, 81 (1a-1b); *SF* 10827,
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 Ilias [bin] Paie *S* 17906 (1d-1e); *S*
 25828 (1a).
 Ilias [bin] Paie & Mamit *S* 29036
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 Jacobs 5012 (1a).
 James & Aban *SAN* 65010 (1a).

- Jilimin & Kapin bin Sisiron *SAN* 17256 (1f).
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 Kiah *SF* 35335 (1a).
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 Kochummen *FRI* 2148 (2); *FRI* 2655 (1c).
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 Moysey & Kiah *SF* 31096, *SF* 31098 (1a-1b).
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 Ramos & Convocar *BS* 83821, *BS* 83826, *BS* 83906 (1a).
 Ramos & Pascasio *BS* 34707, *BS* 35106, *BS* 35135 (1a).
 Ridley 16042 (1b).
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 van Royen & Sleumer 5838, 6482, 6564 (1a); 8167 (4).
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 Sinclair & Kadim 10403 (1d).
 Soepadmo 952 (1b).
 Soepadmo & Mahmud 1071, 1163 (1b).
 Stauffer, Henty, & Whitmore 5548 (1a).
 Steup *bb* 14901, *bb* 15022 (1a).
 Sulit *PNH* 6330, *PNH* 6447 (1a); *PNH* 21619, *PNH* 21699, *PNH* 21706 (1a-1g).
 Symington 28039 (1a).
 Tan *SAR* 28803 (1d-1e).
 Teysmann 11235 (1f).
 Turkey bin Tran *S* 27820 (1a).
 Versteegh *BW* 3075, *BW* 3916 (1a).
 Whitmore *BSIP* 1213, *FRI* 12061 (1a); *FRI* 12102, *FRI* 12367, *FRI* 12374 (1a-1b); *FRI* 12448 (1a); *FRI* 12459, *FRI* 12648 (1a-1b); *FRI* 12779, *FRI* 12793, *FRI* 12884 (1a).
 deWilde & deWilde-Duyfjes 13105, 13353, 13751, 13997, 14059 (1a-1b).
 Winkler 3309 (1a).
 Womersley *NGF* 17824 (1a).
 Wood *SAN A* 4175 (1f).
 Wray 2106, 3029 (1a).
 Yacup *S* 8264 (1a).
 Zehnder *S* 21598 (1c).
 Zen *Arboretum No.* 966 (1d).

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